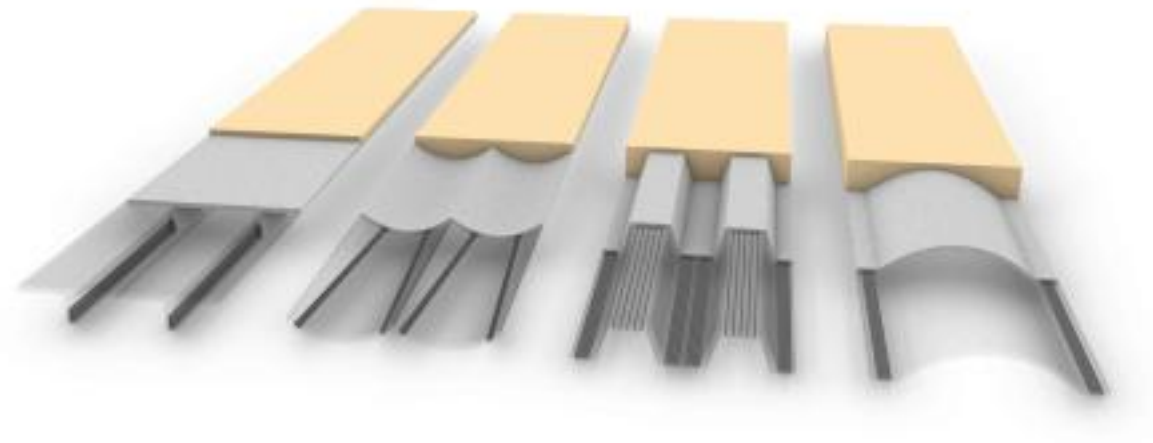
Replacing heavy concrete ceilings: prefabricated ceiling elements made of carbon concrete

About this project



CaPreFloor

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Markets:

Material: Textile-reinforced concrete

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This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

Technology Transfer Program Leichtbau

Context

Concrete is the most widely used building material in the world. Large quantities of greenhouse gases are emitted, particularly during the production of cement, which forms the basis for the manufacture of concrete. Cement production is responsible for around 8 per cent of global CO# emissions. It is therefore crucial for the transformation of the construction sector to reduce cement consumption in particular. One option is to gradually replace steel with pre-stressed carbon fibre reinforcement. This leads to an increase in material and energy efficiency, as it creates lean, mass-reduced and therefore resource-saving structures. A particularly interesting area of application is the use of carbon concrete in the area of floor slabs, for which large quantities of reinforced concrete are used in conventional construction methods.

Purpose

The project partners want to replace the 30 cm thick concrete ceilings usually used in solid construction with lightweight, non-corrosive load-bearing structures. To do this, they are using concrete elements pre-stressed with carbon, the cross-section of which they are reducing to a maximum of 10 cm. The researchers are focussing on prefabricated ceiling elements. These are particularly sustainable, as less waste is produced during manufacture, they are easier to dismantle and can be reused more easily. The carbon pre-stressed ceiling systems should fulfil all structural, fire, thermal and sound insulation requirements and at the same time be practicable.

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Procedure

These sustainable ceilings are developed and tested using a multidisciplinary approach. This includes developing the manufacturing methods, including the plant technology, as well as forecasting and validating the quality of the ceilings. In a comprehensive test programme, the carbon concrete components are tested for their load-bearing and deformation behaviour under short and long-term effects. This includes airborne and impact sound insulation as well as fire protection. The test results are used to validate the numerical calculation models that are used in all disciplines and with which the various parameters are optimised as a whole. The dimensioning of the component cross-sections, including the fasteners and supports, is carried out in accordance with applicable standards as part of the structural analyses. In addition to the small-scale tests, real-scale models are built and tested.

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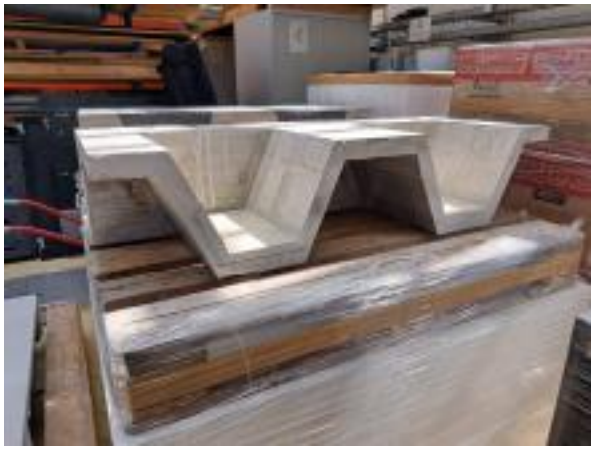

Funding duration:

Funding sign:	03LB3089	**Funding amount:**	EUR 1.9 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3089A - CaPreFloor in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

thomas allton GmbH

Lightweighting classification

	Realisation
Offer	
Products Parts and components, Machines and plants, Tools and moulds	✓
Services & consulting Testing and trials	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight manufacturing	✓
Functional integration	
Measuring and testing technology Component and part analysis, Others (Building acoustics and fire resistance)	✓
Modelling and simulation	
Plant construction & automation Plant construction, Automation technology, Handling technology	✓
Recycling technologies	
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology Casting (concrete)	✓
Forming	
Joining	
Material property alteration	
Primary forming	
Processing and separating	
Textile technology Knitting, laid web production	✓

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Textile-reinforced concrete	✓
Fibres	
Functional materials	
Metals	
Plastics	
Structural ceramics	
(Technical) textiles	